specific property of a plastic explosive object in said item of luggage or package, and automatically discriminate said plastic explosive object from harmless plastic, plastic-like and other objects that are present based on said calculated value of said specific property, utilizing x-ray transmission data of rays passing through said item of luggage or package, and near but not through said plastic explosive object to remove by computer calculation the contribution of unwanted overlying and underlying material from the calculated value of said specific property of said plastic explosive object; and

said computer programmed to automatically indicate, based on said discrimination, presence of said plastic explosive object while said item of package or luggage progresses on said conveyor.

58. The device of claim 57 wherein said computer calculates said specific property of said plastic explosive object by effectively combining data from many different rays that pass through said plastic explosive object.

59. The device of claim 57 or 58 wherein said calculated specific property is a physical characteristic of said plastic explosive object.

60. The device of claim 59 wherein said physical characteristic is the atomic number Z.

61. The device of claim 57 or 58 wherein said computer automatically indicates possible presence and location of said plastic explosive object on a video display.

62. The device of claim 57 or 58 wherein said stationary X-ray exposure system includes at least one fixed X-ray source constructed and arranged to emit a fan beam of said X-rays.

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7 ~~63.~~ 6 The device of claim ~~62~~ wherein said X-ray source emits alternately pulses of X-ray radiation of two substantially different X-ray energies.

8 ~~64.~~ The device of claim ~~57~~ 1 or ~~58~~ 2 wherein said stationary X-ray detection system includes at least one fixed X-ray detector constructed and arranged to detect X-ray radiation transmitted through said item of luggage or package.

9 ~~65.~~ The device of claim ~~62~~ 6 further comprising an X-ray controller operatively connected to said X-ray source and arranged to control timed emissions of X-ray pulses from said X-ray source at a high energy band and at a low energy band.

10 ~~66.~~ The device of claim ~~65~~ 9 wherein said X-ray pulses are about 70 kVp and about 140 kVp.

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11 ~~67.~~ The device of claim ~~65~~ 9 wherein said X-ray controller, said X-ray source, said X-ray detectors and said computer operate co-operatively so that said detector collects X-ray data during emission of said X-ray pulses from said X-ray source transmitted through said item of luggage or package and said detector collects "no X-ray flux" data when no X-rays irradiate said detector, said computer further programmed to receive both said X-ray data and said "no X-ray flux" data from said detectors and to correct said X-ray data by subtracting said "no X-ray flux" data from said X-ray data.

12 ~~68.~~ The device of claim ~~57~~ 1 or ~~58~~ 2 wherein said stationary X-ray exposure system includes at least one X-ray source constructed to emit polychromatic X-ray radiation, and said stationary X-ray detection system includes two sets of X-ray detectors that detect X-ray radiation of at least two substantially different X-ray energies.

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13 ~~69~~. The device of claim ~~68~~ 12 wherein said X-ray source and said X-ray detectors operate co-operatively with an X-ray blocking means so that each said set of X-ray detectors collects X-ray data transmitted through said item of luggage or package without employing said X-ray blocking means and each said set of X-ray detectors also collects "no X-ray flux" data by employing said X-ray blocking means to block X-ray radiation emitted from said source, said computer further programmed to receive both said X-ray data and said "no X-ray flux" from said detector and to correct, for each detector, said X-ray data by subtracting said "no X-ray flux" data from said X-ray data.

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14 ~~70~~. The device of claim 1 or 2 wherein said computer further including a lookup table comprising sets of X-ray underlying or overlying data associated with X-ray transmission data through different materials, and said computer constructed to recall selectively from said lookup table X-ray underlying or overlying data of a selected material and remove from said X-ray transmission data absorption contribution attributable to said selected material utilizing said X-ray underlying or overlying data.

15 ~~71~~. The device of claim 14 wherein said selected material is a metal.

16 ~~72~~. The device of claim 15 wherein said lookup table comprises said X-ray underlying or overlying data over a range of thicknesses of said materials.

17 ~~73~~. The device of claim 1 or 2 wherein said computer is further programmed to determine an image of said plastic explosive object by first identifying a region exhibiting the specific property of the plastic explosive object and then employing a dilatation algorithm to said X-ray transmission data.

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18 ~~74.~~ The device of claim 17 ~~73~~ wherein the determined image of said plastic explosive object is displayed on a video display.

19 ~~75.~~ The device of claim 17 ~~73~~ wherein presence of said plastic explosive object is indicated by an alarm.

20 ~~76.~~ The device of claim 17 ~~73~~ wherein said computer is further programmed to reduce noise of the determined image by applying an erosion algorithm.

21 ~~77.~~ The device of claim 20 ~~76~~ wherein said noise-reduced image is displayed on a video display.

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22 ~~78.~~ The device of claim 1 ~~57~~ or 2 ~~58~~ in combination with a CT scanner constructed and arranged to examine said item of luggage or package.

23 ~~79.~~ The device of claim 1 ~~57~~ or 2 ~~58~~ including said X-ray exposure system and said X-ray detection system constructed and arranged to scan said item to provide information relevant to three dimensional spatial configuration of objects in said item of luggage or package, after said computer automatically indicates presence of said plastic explosive object.

24 ~~80.~~ The device of claim 1 ~~57~~ or 2 ~~58~~ further comprising a CT scanner, responsive to said computer, constructed and arranged to receive said item of luggage or package on a conveyer and to CT scan said item after said computer automatically indicates presence of said plastic explosive object.

25 ~~81.~~ The device of claim 2 ~~58~~ further comprising a CT scanner operatively connected to and receiving indication identifying suspect slices of said item of luggage or package from said computer, said CT scanner constructed and arranged to CT scan said identified suspect slices where said plastic explosive object is indicated.

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82. A device for detecting plastic explosive objects in packages or luggage which contain harmless plastic, plastic-like or other objects, comprising:

a conveyor for sequentially moving said packages or luggage through an inspection region,

a stationary X-ray source, located near said inspection region and positioned to expose sequentially said packages or luggage in said inspection region to a flux of X-ray radiation of at least two substantially different energies,

stationary X-ray detectors positioned to detect X-ray radiation transmitted through an item of luggage or package, said detectors providing data corresponding to the intensity of transmitted radiation, and said detectors also providing detector outputs representing "no X-ray flux" data taken when no X-ray radiation is arriving at said detectors, said "no X-ray flux" data taken repeatedly during exposure of said luggage or package, and

a computer operatively connected to said detectors to receive from each said detector both said X-ray data and said "no X-ray flux" data, said computer programmed to correct, for each detector, said X-ray data by eliminating contribution of said "no X-ray flux" data to said X-ray data and to determine, from said corrected X-ray data, the presence of said plastic explosive object while said item of luggage or package progresses on said conveyor.

83. The device of claim 81 further comprising an X-ray controller operatively connected to said X-ray source and arranged to control timed emissions of X-ray pulses from said X-ray source at a high energy band and at a low energy band, said X-ray detectors being constructed and arranged to detect separately said X-ray pulses of said high energy band and said low energy band, said detectors taking said "no X-ray flux" data between emission of said X-ray pulses.

84. The device of claim 83 wherein said "no X-ray flux" data are collected for each said X-ray pulse.

85. The device of claim 83 wherein said computer eliminates said contribution of said "no X-ray flux" data to said X-ray data by subtracting said "no X-ray flux" data from said X-ray data.

86. The device of claim 82 wherein said X-ray source is constructed to emit polychromatic X-ray radiation, and said X-ray detectors include two sets of detectors being sensitive to low energy X-ray radiation and high energy X-ray radiation, said device further comprising an X-ray blocking means, operating co-operatively with said detectors, for intermittently blocking polychromatic X-ray radiation, and said detectors collecting said "no X-ray flux" data by employing said X-ray blocking means.

87. The device of claim 86 wherein said computer eliminates said contribution of said "no X-ray flux" data to said X-ray data by subtracting said "no X-ray flux" data from said X-ray data.

88. The device of claim 83 or 86 wherein said computer calculates a value of a specific property of a plastic explosive object in said item of luggage or package, and automatically discriminate said plastic explosive object from harmless plastic, plastic-like and other objects that are present based on said calculated value of said specific property, utilizing x-ray transmission data of rays passing through said item of luggage or package, and near but not through said plastic explosive object to remove by computer calculation the contribution of unwanted overlying and underlying material from the calculated value of said specific property of said plastic explosive object, and

said computer also programmed to automatically indicate, based on said discrimination, presence of said plastic explosive object while said item of luggage or package progresses on said conveyor.

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89. The device of claim 88 wherein the calculation of said specific property of said plastic explosive object includes the function of effectively combining data from many different rays that pass through said plastic explosive object.

90. The device of claim 82 wherein said X-ray source and said X-ray detectors further arranged to provide information relevant to three dimensional spatial configuration of objects in said item of luggage or package.

91. A device for detecting specific material of interest in an ensemble of objects, comprising:

a conveyor for sequentially moving an ensemble of objects through an inspection region,

a stationary X-ray exposure system located at said inspection region and positioned to expose sequentially said ensemble of objects in said inspection region to X-ray radiation of at least two substantially different energies,

a stationary X-ray detection system positioned to detect X-ray radiation transmitted through said ensemble of objects, said detection system providing data corresponding to the intensity of transmitted radiation of said two energies,

a computer operatively connected to said detection system to receive said data and programmed to calculate a value of a specific property of said specific material of interest in said ensemble of objects, and automatically discriminate said specific material of interest from other objects that are present based on said calculated value of said specific property, utilizing x-ray transmission data of rays passing through said ensemble of objects, and near but not through said specific material of interest to remove by computer calculation the contribution of unwanted overlying and underlying material from the calculated value of said specific property of said specific material of interest, and

said computer programmed to automatically indicate, based on said discrimination, presence of said specific material of

interest while said ensemble of objects progresses on said conveyor.

92. The device of claim 91 wherein the calculation of said specific property of said specific material of interest includes the function of effectively combining data from many different rays that pass through said specific material of interest.

93. The device of claim 91 or 92 wherein said specific material of interest is one of the following: plastic explosives, other explosives, drugs, and money.

94. A system for detecting a specific material of interest within a package or suitcase comprising:

an X-ray inspection unit constructed to acquire X-ray transmission data of said package or suitcase and indicate from said transmission data a suspect package or suitcase that warrants further detailed inspection by CT scanning, and

a CT scanner for CT scanning said suspect package or suitcase of said package to detect presence of said specific material of interest.

95. The system of claim 94 wherein said X-ray inspection unit identifies suspect regions of said suspect package or suitcase and said CT scanner examines only said identified suspect regions.

96. The system of claim 94 wherein said X-ray inspection unit identifies suspect slices of said suspect package or suitcase and said CT scanner examines only said identified suspect slices.

97. The system of claim 94 wherein said X-ray inspection unit employs at least one fixed X-ray source and at least one fixed X-ray detector constructed and arranged to acquire said X-ray transmission data.

42 98. The system of claim 38 wherein said X-ray inspection unit includes a conveyor constructed to move said package or suitcase, a fixed X-ray source constructed and arranged to emit a fan beam of X-rays of multiple energies, and a fixed X-ray detector constructed and arranged to obtain dual energy X-ray transmission data of said package or suitcase.

43 99. The system of claim 38 wherein said CT scanner is adapted to perform dual energy X-ray CT scanning.

44 100. The system of claim 41 wherein said fixed x-ray source is constructed to emit alternately pulses of x-ray radiation of two effectively monoenergetic X-ray bands.

45 101. The system of claim 38 wherein said X-ray inspection unit employs at least one fixed x-ray source and X-ray detector system, said x-ray source constructed to emit polychromatic x-ray radiation, said X-ray detector system includes two sets of detectors being sensitive to low energy x-ray radiation and high energy x-ray radiation.

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102. A system for detecting a specific material of interest within a package or luggage comprising:

a stationary X-ray source system and a stationary X-ray detection system, both connected to a computer, constructed to acquire in a dual energy X-ray transmission data of said package or suitcase and indicate therefrom a suspect package or suitcase that warrants further detailed inspection by CT scanning, and

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said X-ray source system and said X-ray detection system constructed and arranged to provide information relevant to three dimensional spatial configuration of materials in said luggage or package.

103. The system of claim 102 wherein said X-ray source and said X-ray detector, operating in said fixed arrangement, constructed and arranged to identify suspect slices of said

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suspect package or suitcase and then said X-ray source and said X-ray detector, operating in said CT scanning mode, examine only said identified suspect slices.

104. The system of claim 94 or 102 wherein said X-ray inspection unit employs a computer programmed to process said X-ray transmission data to calculate a value of a physical property of an examined material present in said package or suitcase by substantially removing contribution of unwanted underlying or overlying material to said determined value of said physical property, and then compare said calculated value of said physical property to a known value of said physical property of the specific material of interest in order to identify said suspect slices.

105. The system of claim 104 wherein said physical property is the atomic number Z.

106. The system of claim ~~94~~ or ~~102~~ wherein said X-ray inspection unit employs a computer programmed to calculate a value of a specific property of said specific material of interest in said item of luggage or package, and automatically discriminate said specific material of interest from other objects that are present based on said calculated value of said specific property, utilizing x-ray transmission data of rays passing through said item of luggage or package, and near but not through said specific material of interest to remove by computer calculation the contribution of unwanted overlying and underlying material from the calculated value of said specific property of said specific material of interest, and

said computer programmed to automatically indicate, based on said discrimination, presence of said specific material of interest while said item of luggage or package progresses on said conveyor.

52 ~~107.~~ The device of claim ~~106~~ 51 wherein the calculation of said specific property of said specific material of interest includes the function of effectively combining data from many different rays that pass through said specific material of interest.

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108. The system of claim 106 or 107 wherein said specific property is a physical property of said specific material of interest.

54 ~~109.~~ The system of claim ~~108~~ 53 wherein said physical property is the atomic number Z.

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110. The system of claim 104 and 106 further including a visual display that images location and shape of said specific material of interest by highlighting edges corresponding to detected edges of said specific material along with adjacent areas having similar characteristics to fill in along the detected edges.

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55 ~~111.~~ The system of claim ~~94~~ 38 or ~~102~~ 48 wherein said CT scanner operates on-line in real time.

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112. A method of detecting specific material of interest in an ensemble of objects, comprising:

providing a stationary X-ray exposure system, a stationary X-ray detection system, and a computer operatively connected to said detection system,

moving sequentially on a conveyor an ensemble of objects through an inspection region,

exposing, at said inspection region, said ensemble of objects to X-ray radiation of at least two substantially different energies,

detecting X-ray radiation transmitted through said ensemble of objects, and providing to said computer X-ray data

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corresponding to the intensity of transmitted radiation of said two energies,

calculating a value of a specific property of a specific material of interest in said ensemble of objects, and automatically discriminating said specific material of interest from other objects that are present based on the calculated value of said specific property,

utilizing x-ray transmission data of rays passing through said ensemble of objects, and near but not through said specific material of interest to remove by computer calculation the contribution of unwanted overlying and underlying material from the calculated value of said specific property of said specific material of interest, and

automatically indicating, based on said discrimination, presence of said specific material of interest while said ensemble of objects progresses on said conveyor.

113. The method of claim 112 wherein said calculation step includes effectively combining data from many different rays that pass through said specific material of interest.

114. The method of claim 112 or 113 wherein said specific material of interest is one of the following: plastic explosives, other explosives, drugs, and money.

115. The method of claim 112 or 113 further comprising the step of providing information relevant to three dimensional spatial configuration of materials in said luggage or package.

116. A method of detecting plastic explosive objects in packages or luggage which contain harmless plastic, plastic-like or other objects, comprising:

providing a stationary X-ray source, stationary X-ray detectors, and a computer operatively connected to said detector,

moving sequentially on a conveyor an ensemble of objects through an inspection region,

exposing, at said inspection region, said ensemble of objects to a flux X-ray radiation of at least two substantially different energies,

detecting X-ray radiation transmitted through said ensemble of objects, and providing to said computer X-ray data corresponding to the intensity of transmitted radiation of said two energies,

providing to said computer detector outputs representing "no X-ray flux" data taken when no X-ray radiation is arriving at said detectors, said "no X-ray flux" data taken repeatedly during the exposure of said luggage or package,

correcting, for each detector, said X-ray data by eliminating contribution of said "no X-ray flux" data to said X-ray data, and

determining, from said corrected X-ray data, the presence of said plastic explosive object while said item of luggage or package progresses on said conveyor.

117. A method for detecting a specific material of interest within packages or luggage comprising the steps of:

moving sequentially on a conveyor packages or luggage,

acquiring X-ray transmission data of an item of luggage or package, using an X-ray inspection unit with a stationary X-ray source-detector system, and indicating from said X-ray transmission data a suspect item of luggage or package that warrants further detailed inspection by CT scanning, and

CT scanning said suspect item of luggage or package to detect said specific material of interest.

118. The method of claim 117 wherein said CT scanning step provides information relevant to three dimensional spatial configuration of materials in said luggage or package.

Please apply any charges not covered, or any credits, to

Deposit Account 06-1050.

Respectfully submitted,

Date: MAR 1 3 1995

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